REMARKS

Claims 1, 6-8, 13, 16-17 and 46-48 have been amended. Claims 49-52 have been added. Claims 1, 6-13, 16-17 and 46-52 are now pending. A RCE and Petition for Extension of Time (five-months) is being filed concurrently herewith. Applicants reserve the right to pursue the original claims and other claims in this and other applications. Applicants respectfully request reconsideration of the above-referenced application in light of the amendments and following remarks.

Claims 1, 6-8, 10-13, and 16-17 stand rejected (in the Office Action dated January 10, 2005) under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,319,553 ("McInerney") in view of U.S. Patent No. 5,935,334 ("Fong"). The rejection is respectfully traversed.

The cited references do not disclose or suggest an atomic layer doping apparatus comprising, *inter alia*, "a first atomic layer doping region for depositing a first dopant species with a first reaction process . . . in the first atomic layer doping region; a second atomic layer doping region for diffusing said first dopant species in [a] first substrate with a second reaction process, wherein said first and second atomic layer doping regions are chemically isolated from one another by a *vertical* inert gas curtain, and wherein said second reaction process is different from said first reaction process; and a *central* loading robot assembly for moving said first substrate from said first doping region *laterally* through said *vertical* inert gas curtain to said second doping region," as recited in claim 1 (emphasis added).

McInerney does not disclose or suggest that a substrate is moved *laterally* through a *vertical* inert gas curtain, or a *central* loading robot assembly that moves a substrate *laterally through* a vertical inert gas curtain to a second doping region. For instance, McInerney discloses in FIGS. 10 and 11, an embodiment with purge plate 210

used to flow argon between the stations of chamber 100. McInerney, however, discloses that "spindle 109 projects from top surface 108 of chamber base 102 and is used to *lift* wafer indexing plate 104 and rotate wafer indexing plate 104 in a clockwise direction when the wafers in chamber 100 are to moved to the next processing station." (Col. 4, ll. 22-26) (emphasis added).

McInerney's structure merely provides an inert gas flow between processing chambers; but, does not teach or suggest a *central* loading robot assembly that can move a substrate *laterally* through a *vertical inert gas curtain.* McInerney *lifts* the substrate above one reaction chamber, moves the substrate to another reaction chamber, and then lowers the substrate into the second reaction chamber via wafer indexing plate 104.

The Office Action asserts that McInerney's "loading assembly does 'move' through an inert gas curtain," and cites McInerney's col. 11, ll. 54-57 for support (p. 10). McInerney's col. 11, ll. 54-57 merely provides that "[p]urge plate 210 continues to flow argon throughout the deposition process, including *during the rotation of* wafer indexing plate 104 with the wafers." McInerney's col. 11, ll. 54-57 does not support the Office Action's statement that a loading assembly moves a substrate *laterally* through a *vertical* inert gas curtain. As indicated above, McInerney discloses *lifting* the wafer straight up, rotating the wafer, and then lowering it into another reaction chamber.

With respect to all of the pending claims, the Examiner noted "that whether or not McInerney teaches the loading assembly as 'lifting' the wafer is immaterial because McInerney also clearly teaches that the loading assembly as 'rotating', so that the wafers are clearly moved through the inert gas curtain." (Office Action, p. 10). Applicants respectfully disagree. The fact that McInerney specifically teaches *lifting* the wafer, and then rotating it to another chamber. This limitation *is* material and clearly differs from the claimed invention.

Since McInerney discloses a loading assembly that *'lifts'* the wafer, the wafer would be lifted *above* the reaction chamber. The loading assembly would then rotate, and the wafer would be moved *over* the next reaction chamber. The loading assembly would then *lower* the wafer into the next reaction chamber. The wafer would not be *laterally* passed through a *vertical* inert gas curtain. The wafer would be lifted above it.

The Office Action concludes that because the loading assembly rotates, that the wafers would naturally go through an inert gas curtain. However, there is *no support* for this teaching or suggestion in McInerney. This is improper hindsight reconstruction. McInerney must disclose or suggest a wafer that moves *laterally* through a vertical inert gas curtain. Fong is relied upon for teaching a first atomic layer region used for deposition and a second atomic layer region used for driving in the dopant atoms, and adds nothing to rectify the deficiencies associated with McInerney.

Claims 6-8, 10-13, and 16-17, depend from claim 1 and should be similarly allowable along with claim 1 for at least the reasons provided above, and on their own merits.

Claim 9 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over McInerney and Fong, and in further view of U.S. Patent No. 6,207, 005 ("Henley"). The rejection is respectfully traversed.

Dependent claim 9 should be allowable for at least those reasons set forth above with respect to independent claim 1, and on its own merits. Specifically, McInerney and Fong do not teach or suggest a "*central* loading robot assembly for moving said first substrate from said first doping region *laterally* through said *vertical* inert gas curtain to said second doping region," as recited in claim 1 (emphasis added). Henley is relied upon for teaching three deposition regions and adds nothing to correct

the deficiencies found in McInerney and Fong.

Claim 46 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over McInerney in view of Fong and further in view of European patent app. no. 0-060626 ("Gattuso"). The rejection is respectfully traversed.

For similar reasons provided above, McInerney and Fong do not teach or suggest an atomic layer doping apparatus comprising, *inter alia*, "a first atomic layer doping region for depositing a first dopant species with a first reaction process . . . in the first atomic layer doping region; a second atomic layer doping region for diffusing said first dopant species in [a] first substrate with a second reaction process . . . being chemically isolated from one another by a *substantially vertical* inert gas curtain, wherein said substantially *vertical* inert gas curtain is provided at a higher pressure than an atmosphere containing said first dopant species, and wherein said second reaction process is different from said first reaction process; and, a *central* loading robot assembly for moving said first substrate from said first doping region to said second doping region *laterally* through said substantially *vertical* inert gas curtain," as recited in claim 46 (emphasis added).

McInerney and Fong do not teach or suggest a *central* loading assembly that moves a substrate *laterally through* a substantially *vertical* inert gas curtain, or that the inert gas curtain is provided at a higher pressure than the first dopant species. McInerney's apparatus employs a wafer indexing plate 104 that *lifts* the substrate from one region and transports it to another. It is impossible to move a substrate *laterally* through an inert gas curtain with McInerney's apparatus without a major redesign of McInerney's apparatus. Gattuso is relied upon for disclosing the use of an inert gas curtain at a higher pressure than the reaction gases, and adds nothing to rectify the deficiencies associated with McInerney and Fong.

The Office Action acknowledges that "McInerney is silent on the pressure at which the inert gas is supplied." (p. 10). Claim 46 recites, *inter alia*, that "the substantially vertical inert gas curtain is provided at a higher pressure than an atmosphere containing said first dopant species." There is no disclosure or suggestion in McInerney to provide a substantially vertical inert gas curtain at a higher pressure than the first dopant species. The exhaust gas port 140 provides a way of evacuating the chambers in McInerney. The exhaust gas port 140 establishes a pressure difference by way of the exhaust gas port vacuum pump 142. Since a pressure gradient is established through annular gaps 126a and 128a by vacuum pump 142, there is no reason or motivation to provide McInerney's inert gas with a higher pressure than the first dopant species.

To establish a *prima facie* case of obviousness, three requirements must be met: (1) some suggestion or motivation, either in the references themselves or in the knowledge of a person of ordinary skill in the art, to modify the reference or combine reference teachings; (2) a reasonable expectation of success; <u>and</u> (3) the prior art reference (or references when combined) must teach or suggest all the claim limitations. More importantly, the teaching or suggestion to make the claimed combination and the reasonable expectation for success <u>must both be found in the prior art</u> and not based on the Applicants' disclosure. *See, e.g., In re Royka,* 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974).

In this case, there is <u>no</u> disclosure in the cited references to combine Gattuso's inert gas curtain having a higher pressure with McInerney's inert gas, when McInerney *already* provides a pressure gradient established by vacuum pump 142. To combine the references is improper hindsight reconstruction. The cited references simply do not teach or suggest that "the substantially vertical inert gas curtain is provided at a higher

pressure than an atmosphere containing said first dopant species," as recited in claim 46.

Claim 47 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over McInerney in view of Fong, Gattuso, and to U.S. Patent No. 5,382,126 ("Hartig"). The rejection is respectfully traversed.

McInerney, Fong, and Gattuso do not teach or suggest an atomic layer deposition apparatus comprising, *inter alia*, "a first atomic layer doping region for depositing a first dopant gas species with a first reaction process . . . in the first atomic layer doping region . . . exhausted through a first gas port; a second atomic layer doping region for diffusing said first dopant gas species in said substrate with a non-reactive gas species with a second reaction process, said first and second doping regions being chemically isolated from one another by a *vertical* inert gas curtain provided at a higher pressure than an atmosphere containing said first dopant gas species, wherein said non-reactive gas species is exhausted through a second gas port, and wherein said second reaction process is different from said first reaction process; and a *central* loading robot assembly for moving said first substrate from said first doping region to said second doping region *laterally* through said *vertical* inert gas curtain," as recited in claim 47 (emphasis added).

McInerney, Fong and Gattuso do not teach or suggest a first atomic doping layer region with a first gas port and a second atomic doping layer region with a second gas port. Further, neither references teach alone, or in combination, that the first and second atomic doping regions are separated by a *vertical* inert gas curtain provided at a higher pressure than said first dopant gas species. Further still, the references do not teach or suggest moving a substrate *laterally* through a *vertical* inert gas curtain with a central loading robot assembly. As discussed above, McInerney discloses lifting the

substrate up, rotating it, and then lowering it. Hartig is relied upon the use of separate gas exhaust ports for each chamber, and adds nothing to rectify the deficiencies of McInerney, Fong, and Gattuso.

The Office Action asserts that Hartig provides motivation to combine for purpose of "aspirating gas from each chamber and further preventing gas transfer between the individual chambers." (p. 8). However, "[t]he mere fact that references can be combined or modified *does not* render the resultant combination obvious unless the prior art also *suggests* the desirability of the combination." M.P.E.P. § 2143.01 (emphasis added). In this case, McInerney already discloses an exhaust port 140. Additional exhaust ports to McInerney's structure would require a major redesign and reconstruction of the apparatus.

It is not proper to combine references where doing so "would require a substantial reconstruction and redesign of the elements shown in [the primary reference, *i.e.*, McInerney] as well as a change in the basic principle under which the [primary reference, *i.e.*, McInerney] construction was designed to operate." *In re Ratti*, 270 F.2d 810, 813, 123 U.S.P.Q. 349, 352 (C.C.P.A. 1959). This is well settled Office policy. See M.P.E.P. § 2143.01, page 2100-127 (Feb. 2003).

McInerney's apparatus would undergo a major redesign and reconstruction of the elements disclosed, if a separate exhaust port is added to each *separate* reaction chamber. Each chamber (FIG. 3) would have to be redesigned to accommodate an exhaust port. McInerney's FIG. 3 illustrates that annular gaps 128a and 126a separate the chambers C and D. Again, Applicants submit that the proposed combination is improper hindsight reconstruction.

In fact, the teaching or suggestion to make the claimed combination and the reasonable expectation for success must both be found in the prior art and not based on the Applicants' disclosure. *See, e.g., In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974). In this case, since the primary reference discloses only *one* exhaust port, there is no motivation to use Hartig's exhaust ports since McInerney's single vacuum port 142 aspirates the gas in each chamber C and D through annular gaps 128a and 126a.

Claim 48 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over McInerney in view of Fong, in view of U.S. Patent No. 6,527,866 ("Matijasevic"), and in further view of U.S. Patent No. 3,618,919 ("Beck"). The rejection is respectfully traversed.

The cited references do not teach or suggest an atomic layer deposition apparatus comprising, *inter alia*, "a first atomic layer doping region comprising a susceptor and a heater assembly . . . [used for] a first reaction process in the first atomic layer doping region; a second atomic layer doping region comprising a susceptor and a heater assembly . . . [used for] a second reaction process, wherein said first and second atomic layer doping regions are isolated from one another by a *vertical* physical barrier having a closeable opening, and wherein said second reaction process is different from said first reaction process; and a *central* loading robot assembly for moving said first substrate from said first doping region to said second doping region *laterally* through said closeable opening of said *vertical* physical barrier," as recited in claim 48.

McInerney, Fong, and Matijasevic do not teach or suggest *laterally* moving a substrate through a *vertical* physical barrier with a central loading robot assembly. Matijasevic is relied upon for the use of individual heaters. Beck is relied upon for disclosing the use of a physical barrier for a gaseous atmosphere. However, "[t]he mere fact that references can be combined or modified does not render the resultant

combination obvious unless the prior art also suggests the desirability of the combination." M.P.E.P. § 2143.01. In this situation, there is no teaching or suggestion for employing a physical barrier having a closeable opening in McInerney.

The reactive gases in McInerney "are drawn down into respective wells 126 and 128, *via annular gaps* 126a and 128a, and have little opportunity to migrate toward another pedestal." (Col. 5, lines 37-41) (emphasis added). "The narrow annular gaps permit little or no recirculation of the reactive gases once the gases are drawn into the wells." (Col. 2, lines 9-11). Thus, the presence of a *vertical* physical barrier having a closeable opening nullifies the importance of annular gaps 126a and 128a. Further, the presence of the annular gaps effectively isolates McInerney's separate reaction chambers. There is no motivation to modify McInerney and obtain Applicants' claimed *vertical* physical barrier having a closeable opening, in the atomic layer doping apparatus recited in claim 48.

Moreover, it is not proper to combine references where doing so "would require a substantial reconstruction and redesign of the elements shown in [the primary reference, *i.e.*, McInerney] as well as a change in the basic principle under which the [primary reference, *i.e.*, McInerney] construction was designed to operate." In re Ratti, 270 F.2d 810, 813, 123 U.S.P.Q. 349, 352 (C.C.P.A. 1959). This is well settled Office policy. See M.P.E.P. § 2143.01, page 2100-127 (Feb. 2003).

The "modification" proposed by the Examiner, in the rejection of claim 48, would require a substantial reconstruction and redesign of McInerney's apparatus. In this case, McInerney already discloses that an inert gas is provided to separate chamber C from chamber D (FIG. 3) through annular gaps. McInerney's structure would have to be redesigned to accommodate a *vertical* physical barrier having a closeable opening.

Moreover, since McInerney discloses *lifting* the substrate from one chamber to another, there would be no motivation to even have a *vertical* physical barrier with a closeable opening. If anything, McInerney would simply use a physical barrier and *not* one with a closeable opening since the substrate in McInerney is lifted from one region to another. By contrast, Applicants' structure moves a substrate from one doping region to another *laterally* through a closeable opening of a *vertical* physical barrier with a central loading robot assembly.

Applicants respectfully submit that the prior art of record does not disclose or suggest the subject matter of newly added dependent claims 49-52. Specifically, the cited references fail to teach or suggest an atomic layer doping apparatus where the "first and second atomic layer doping regions are *separate reaction chambers*, and wherein the reaction chambers *are separated by the vertical inert gas curtain*," as recited dependent claims 49-52 (emphasis added). As indicated above, McInerney discloses that a wafer is lifted from one region, rotated and lowered into another region. Applicants' claimed apparatus employs a central loading robot assembly that moves a substrate *laterally* through an inert gas curtain. Thus, each doping region is a *separate* reaction chamber that is separated from each other by the vertical inert gas curtain. This structural aspect is not disclosed or suggested in the prior art.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

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Respectfully submitted,

By

Thomas J. D'Amico
Registration No.: 28,371
James R. Derry
Registration No.: 57,890
DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP
2101 L Street NW
Washington, DC 20037-1526
(202) 785-9700
Attorneys for Applicants